# Evaluating a new approach to CO2 capture and storage

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Carbon dioxide ($CO_2$) capture, utilization and storage is a climate mitigation technology that could dramatically reduce global emissions of this greenhouse gas, while allowing the energy sector to continue generating electricity at coal-fired and natural-gas power plants. The strategy involves capturing and compressing $CO_2$ at large, stationary sources, such as power plants, and transporting the $CO_2$ in dedicated pipelines to utilization or storage reservoirs. In a perspective paper published in *Greenhouse Gases: Science and Technology*, researchers examined a new approach that could potentially overcome many barriers to deployment and jumpstart this process on a commercial scale.

## Significance of the research

At present, 68 percent of the electricity generated in the United States results from burning fossil fuels, more than half of which uses coal — the most $CO_2$ -intensive source — as the primary energy source. Implementing a capture, utilization, and storage might enable a gradual transition to energy sources that emit less $CO_2$ per unit of energy while continuing to leverage the useful lifetime of the existing energy infrastructure. The strategy could also be employed developing countries that are expanding their fleet of coal-fired power plants. However, the cost of $CO_2$ capture has hindered commercial-scale application of this climate mitigation approach. Implementing $CO_2$ capture in coal-fired power plants could result in almost a doubling of electricity prices for consumers.

The researchers examined near-term market-viable opportunities to demonstrate integrated $CO_2$ capture, utilization, and storage while other pathways for technology development are pursued. As a result of their comparison of approaches, the researchers concluded that a financially viable demonstration of a large-scale process requires offsetting the costs of $CO_2$ capture by using the $CO_2$ as an input to the production of marketable products. The scientists propose that a near-term demonstration of this technology could focus on implementing $CO_2$ capture on facilities that produce high-value chemicals/products such as such as ethanol, iron/steel production, and oil refining. High-value chemicals/products industries collectively emit 360 million tons of $CO_2$ per year, which is roughly the same amount of $CO_2$ that natural gas power plants emit. The scientists' calculations suggest that the high-value chemicals/products facilities could better absorb the expected impact of the marginal increase than could coal-fired power plants. In addition, the captured $CO_2$ could be sold for market-viable products. This alternative method of capturing $CO_2$ and storing from stationary sources could enable a viable commercial-scale demonstrate of the technology.

## Research achievements

The researchers calculated and compared the estimated increase in the cost of the production price of product due to the addition of $CO_2$ capture and storage for fossil fuel-fired power plants and for a series of high-value chemicals/products. Many of the high-value chemicals/products facilities are large in size and clustered in location, which provides logistical advantages for this approach. The estimated proportional increases in price for high-value chemicals/products facilities range between 1 and 15 percent, which is substantially less than the estimated relative increases in the price of fossil-based electricity. The team performed a case study of a successful integrated $CO_2$ capture, utilization, and storage system where $CO_2$ is captured from ethylene producers and used for enhanced oil recovery in the US Gulf Coast region.

## The research team

The researchers include Richard Middleton, Philip Stauffer and Hari Viswanathan of LANL's Computational Earth Science group; J. William Carey of LANL's Earth System Observations group; Jonathan Levine of the DOE National Energy Technology Laboratory; and Jeffrey Bielicki of The Ohio State University.

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***Caption for image below:*** *Estimated produce price increase due to the captured $CO_2$ process.*